

Claims

1. A method of in-situ measuring a required feature of an inspected layer within a structure during a polishing process that is carried out by a polish apparatus, the structure having a surface, the method comprising repeated layer feature measurements each comprising the steps of:

- projecting a pump laser pulse on a pump area of the surface;
- absorbing energy of the pump laser pulse on the surface of the inspected layer;
- generating a sound wave that propagates into the structure;
- projecting a probe laser beam on a probe area of the surface, the probe laser beam being reflected on the probe area forming a reflected probe laser beam;
- measuring properties of the reflected probe laser beam as a function of time;
- determining the required feature of the inspected layer from the measured properties of the reflected probe laser beam as a function of time.

15 2. The method of claim 1, wherein measuring the properties of the reflected probe laser beam comprises measuring the position of the reflected probe laser beam.

3. The method of claim 1, wherein the structure comprises several structure
20 layers having layer boundaries between them, the sound wave being partly reflected at
each layer boundary forming boundary echos and position of the reflected probe laser
beam changing when a boundary echo reaches the probe area.

4. The method of claim 1, wherein the required feature of the layer is determined
25 from a time difference between changes in measured positions of the reflected probe
laser beam due to two subsequent boundary echos of the inspected layer.

5. The method of claim 1, wherein the required feature of the layer is determined from a laser pulse rate.

6 The method of claim 1, wherein the probe laser is pulsed.

7. The method of claim 1, wherein the probe laser beam is generated from pulse laser beam via beam splitter.

8. The method of claim 1, wherein the pulse laser beam is focused on the surface.

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9. The method of claim 1, wherein the surface is a back surface of the structure opposite to a polish surface of the structure being polished.

10. The method of claim 1, wherein the surface is a polish surface of the structure being polished.

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11. The method of claim 1, wherein the inspected layer is adjacent to the polish surface of the structure.

12. The method of claim 1, wherein the probe area and the pump area overlap.

13. The method of claim 1, wherein the probe area and the pump area do not overlap.

14. The method according to claim 1, wherein the inspected layer is the layer being polished and in the step of calculating the thickness of the inspected layer is calculated.

15. The method of claim 1, wherein the structure comprises an additional outer translucent layer of a material translucent to the laser beams.

16. The method of claim 1, wherein the method is used for real time measurements during carrying out a chemical mechanical planarization (CMP) process.

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17. The method of claim 1, wherein the method is used to determine the endpoint of a CMP process.

18. A measuring apparatus for in-situ measurement of a required feature of an

5 inspected layer within a structure during a polishing process, the structure having a surface, the apparatus comprising

- a first laser light source for generating a pump laser pulse;
- a first light guiding means for guiding the pump laser pulse to a pump area of the surface for generating a sound wave that propagates into the structure;
- a second laser light source generating a probe laser beam;
- a second light guiding means guiding the probe laser beam to a probe area of the surface;
- a detector for detecting properties of the probe laser beam after being reflected from the surface of the layer, and providing a detector signal in accordance with properties of the reflected probe laser beam;
- a time measurement means for measuring the time between two events;
- a calculating means for calculating the required feature of the layer using the detector signal and the measured elapsed time between two events.

20 19. The method of claim 18, wherein the properties of the reflected probe laser beam comprises measuring the position of the reflected probe laser beam.

20. The measuring apparatus of claim 18, wherein the second laser light source is a pulsed laser generating a probe laser pulse.

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21. The measuring apparatus of claim 18, wherein the first and second laser light sources are identical.

22. The measuring apparatus of claim 18, further comprising a beam splitter and a

30 delay-stage.

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23. The measuring apparatus of claim 18, wherein the pump area and the probe area of the surface overlap.

24. The measuring apparatus of claim 18, wherein the detector is a position
5 resolving detector or a detector array.

25. The measuring apparatus of claim 18, further comprising a device for adjusting a pulse rate of laser pulses.

10 26. The measuring apparatus of claim 18, further comprising a window for the laser beam in a polish head of a polishing apparatus.

27. The measuring apparatus of claim 18, further comprising a window for the laser beam in a polish platen of a polishing apparatus.

15 28. A polishing apparatus comprising the measuring apparatus of claim 18.

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